Valid Comparisons

Any conclusion drawn from an invalid premise is itself invalid

Principle of formal logic

In order for any measures of performance to be meaningful, certain conditions should be met

Only valid, arm's length transactions that are good indicators of the value of similar properties should be used. Types of sales that should ***not*** be considered are:

- Blanket Transactions
- Speculator purchases
- Sales between related parties
- Partial interests
- Bids, foreclosures or sales with no, or atypical, financing
- Sales that anticipate a change in use of the property
- Sales where the property itself was significantly different at time of sale than at time of valuation
- Sales of extremely unusual properties
- Sales reported from Records Department with interpolated prices

Any study that uses unfiltered sales data is ***not*** reliable!

Sales Price ≠ Value

It is important to understand that Sale Price is not the same as Value. There is an inherent degree of variability in sales price for which no predictive model or technique can account. Value is an estimate of the ***most probable price*** that a buyer will offer and for which a seller will sell.

Variance in price can occur for any or all of these reasons:

- Change to the property itself (Addition, Rehab, teardown, change in use)
- Change in market bias or desirability
- Degree of error in time adjustment calculations
- Short term fluctuations in supply and demand relationships
- Attributes not present in the model (Interior condition, baths, external influences, traffic)
- Relative negotiating skills of the buyer and seller
- Financial incentives or programs (Abatements, grants, interest rates)
- Availability of financing
- Butterflies in China (for those who ascribe to mathematical chaos theory)

Like horseshoes and hand grenades, getting close is what counts in the assessment industry!

Single Family by Zone

Using the correct source for sales data and scrubbing the file to remove invalid sales, this is the result of the AVI ratio study for single family residences

Performance was measured at 3 points in time – at the start of the project; after the model projections; and after the Evaluation staff had reviewed the projections and made corrections

Actual Value Initiative - Ratio Statistics by Zone														
Comparing the AVI value of properties that sold against time adjusted prices. Only single family properties that had not changed were considered														
				Median Ratio			Price Related Differential			Coefficient of Dispersion			% Improved	EV Effect
Zone	Count	Percent	AdjR2	Start	Projected	Final	Start	Projected	Final	Start	Projected	Final		
A	700	3.5%	89.7%	.310	.967	.968	1.102	1.024	1.030	.328	.173	.168	48.6%	2.7%
B	505	2.5%	80.2%	.485	.972	.972	1.116	1.059	1.059	.287	.203	.203	29.3%	0.0%
C	4,227	21.0%	86.3%	.406	.992	.988	.992	1.013	1.016	.110	.088	.090	18.6%	-2.4%
D	2,003	10.0%	78.2%	.416	.999	.999	1.004	1.011	1.011	.095	.079	.079	17.0%	-0.1%
E	1,968	9.8%	82.0%	.402	.994	.994	1.011	1.014	1.014	.116	.093	.093	19.8%	0.1%
F	2,175	10.8%	82.0%	.323	.977	.977	.931	1.051	1.051	.412	.197	.197	52.2%	0.2%
G	507	2.5%	85.9%	.259	1.005	1.005	.993	1.030	1.030	.621	.169	.169	72.8%	0.2%
H	502	2.5%	78.9%	.373	1.055	1.087	1.130	1.108	1.112	.567	.257	.240	57.6%	6.4%
J	1,841	9.2%	86.0%	.222	1.000	1.000	.918	1.045	1.044	.383	.169	.169	55.9%	0.1%
K	1,151	5.7%	90.5%	.298	1.030	1.030	.855	1.050	1.050	.586	.192	.192	67.3%	0.0%
L	253	1.3%	80.5%	.376	.981	.981	1.005	1.031	1.031	.255	.145	.144	43.5%	0.6%
M	1,750	8.7%	90.4%	.353	.967	.915	.996	1.049	1.075	.244	.192	.199	18.4%	-4.0%
N	1,107	5.5%	82.6%	.388	.998	1.000	.956	1.021	1.016	.264	.102	.097	63.0%	4.3%
P	1,406	7.0%	87.9%	.329	1.004	.999	.916	1.031	1.027	.391	.143	.118	69.8%	17.0%
Overall	20,095	100.0%	84.4%	.380	.993	.990	.970	1.031	1.037	.275	.140	.139	49.5%	0.6%

Condos by Zone

Using the correct source for sales data and scrubbing the file to remove invalid sales, this is the result of the AVI ratio study for single condos

Performance was measured at 3 points in time – at the start of the project; after the model projections; and after the Evaluation staff had reviewed the projections and made corrections

Actual Value Initiative - Ratio Statistics by Zone for Condos														
Comparing the AVI value of properties that sold against time adjusted prices. Only properties that had not changed were considered														
				Median			Price Related Differential			Coefficient of Dispersion			% Improved	EV Effect
Zone	Count	Percent	AdjR2	Start	Projected	Final	Start	Projected	Final	Start	Projected	Final		
A	107	1.4%	93.2%	.219	.689	.747	1.003	1.009	1.024	.624	.135	.140	77.6%	-3.6%
B	1	0.0%	93.2%	.280	.912	.912	1.000	1.000	1.000	.000	.000	.000		
C	1154	15.3%	91.4%	.474	.797	.778	.970	1.017	1.013	.221	.120	.128	42.3%	-6.8%
D	17	0.2%	91.4%	.429	.783	.783	1.025	1.046	1.046	.105	.168	.168	-59.7%	0.0%
F	161	2.1%	93.2%	.404	.814	.835	.930	1.037	1.008	.545	.125	.132	75.7%	-5.6%
G	32	0.4%	93.2%	.128	.710	.868	.921	1.047	.992	.494	.175	.112	77.3%	35.9%
H	118	1.6%	93.2%	.689	.788	.726	1.012	1.017	1.017	.109	.100	.097	10.4%	2.5%
J	305	4.0%	88.2%	.310	.799	.809	.953	1.048	1.024	.446	.140	.113	74.7%	19.6%
K	755	10.0%	88.2%	.631	.796	.793	.930	.995	.995	.262	.141	.125	52.3%	11.4%
M	193	2.6%	94.5%	.384	.857	.787	1.007	.975	.985	.118	.107	.143	-21.7%	-33.6%
N	280	3.7%	94.5%	.470	.926	.839	.932	1.019	1.024	.352	.094	.102	71.1%	-7.8%
P	4418	58.6%	88.4%	.318	.827	.830	.963	1.047	1.007	.450	.136	.132	70.7%	3.0%
Overall	7541	100.0%	91.9%	.378	.821	.814	.986	1.035	1.001	.437	.135	.132	69.9%	2.6%

Accuracy Assessment

The standard ratio study gives a lot of information regarding the quality of assessments, but does not address the overall levels of accuracy of the projected values. OPA runs an analysis of the accuracy of the projections.

We measure the difference between the time adjusted sale price (TASP) and the projected value, and express that difference as a percentage. This analysis answers the questions 'What percentage of our estimates fell within a desired degree of 'closeness' to time adjusted sale prices?' and 'What is the degree of accuracy at percentile intervals?'

Performance was measured at 2 points in time – at the start of the project and after the Evaluation staff had reviewed the projections and made corrections

Example:
Time Adjusted Sale Price = $202000
AVI Projected Value = $195.000
Difference = -$7,000
Ratio ($195,000/ $ 202000) = .965
Percent difference ($ 7,000 / $202,000) = 3.46%

This case would be among the 51.4 % of single family residences where AVI projected value was within 10% of the TASP. It would also be ranked in the 20th percentile of cases where the value fell within 3.5% of the sale price

Where we 'missed', we could miss either low or high. In a perfectly distributed sample, we would expect the projected value to be high about as often as it is low. The accuracy assessment also reports the percentage of cases where the projections appear to be high.

Accuracy Summary

Accuracy Measurements

Table 1 shows the percentage of AVI values that fall within x % of the Time Adjusted Sales Price. For example, 2014 Market Values for 51.4% of Single Family properties that sold were within 10% of the Time Adjusted Sales Price.

"High" measures the percentage of cases where the Market Value to Time Adjusted Sales Price ratio is between 1.03 and the highest ratio for that group. For example, in the 10% group for single family, it represents the percentage of cases that fall between 1.03 and 1.10. It illustrates our intention of 'missing low rather than missing high'.

Only those cases where properties that were substantially the same when valued as they were at the time of sale were considered.

Table 1 - Percentage of Accounts within a Desired Degree of Accuracy

	Single Family			Multi-Family			Condos			Apartments		
Degree of Accuracy	Before AVI	AVI	High	Before AVI	AVI	High	Before AVI	AVI	High	Before AVI	AVI	High
10% (Ratio of .9 to 1.1)	0.4	51.4	28.0%	0.2	49.7	26.4%	1.5	22.8	16.2%	1.4	29.4	24%
15% (Ratio of .85 to 1.15)	0.5	68.5	31.4%	0.5	66.2	27.5%	2.8	37.1	14.0%	1.4	44.5	20%
20% (Ratio of .8 to 1.2)	1.4	78.9	32.8%	0.7	76.4	28.5%	5.1	52.7	11.4%	3.3	63	23%
25% (Ratio of .75 to 1.25)	2.8	86	33.6%	1	83.9	29.3%	8.5	69.3	10.0%	3.3	74.4	24%
50% (Ratio of .5 to 1.5)	11	96.9	36.0%	10.4	96.6	30.5%	31.7	100	7.4%	26.5	96.2	28%

	Mixed Use*			Commercial*			Industrial*		
Degree of Accuracy	Before AVI	AVI	High	Before AVI	AVI	High	Before AVI	AVI	High
10% (Ratio of .9 to 1.1)	5	18.8	32%	6.2	19.1	20.4%	10.4	14.1	21.3%
15% (Ratio of .85 to 1.15)	5.5	26.6	39%	8.4	24.2	23.1%	14.8	20	26.0%
20% (Ratio of .8 to 1.2)	6.8	33	46%	9	32.6	25.8%	18.5	27.4	29.6%
25% (Ratio of .75 to 1.25)	8.5	40.6	50%	10.7	39.9	26.8%	25.9	31.9	30.1%
50% (Ratio of .5 to 1.5)	20.5	60.9	90%	33.1	69.1	29.2%	54.8	52.6	29.7%

Table 2 - Degree of Accuracy at Xth Percentile

In each percentile represented below, this table shows the percentage difference between the 2014 Market Value and the Time Adjusted Sales Price for each property type.

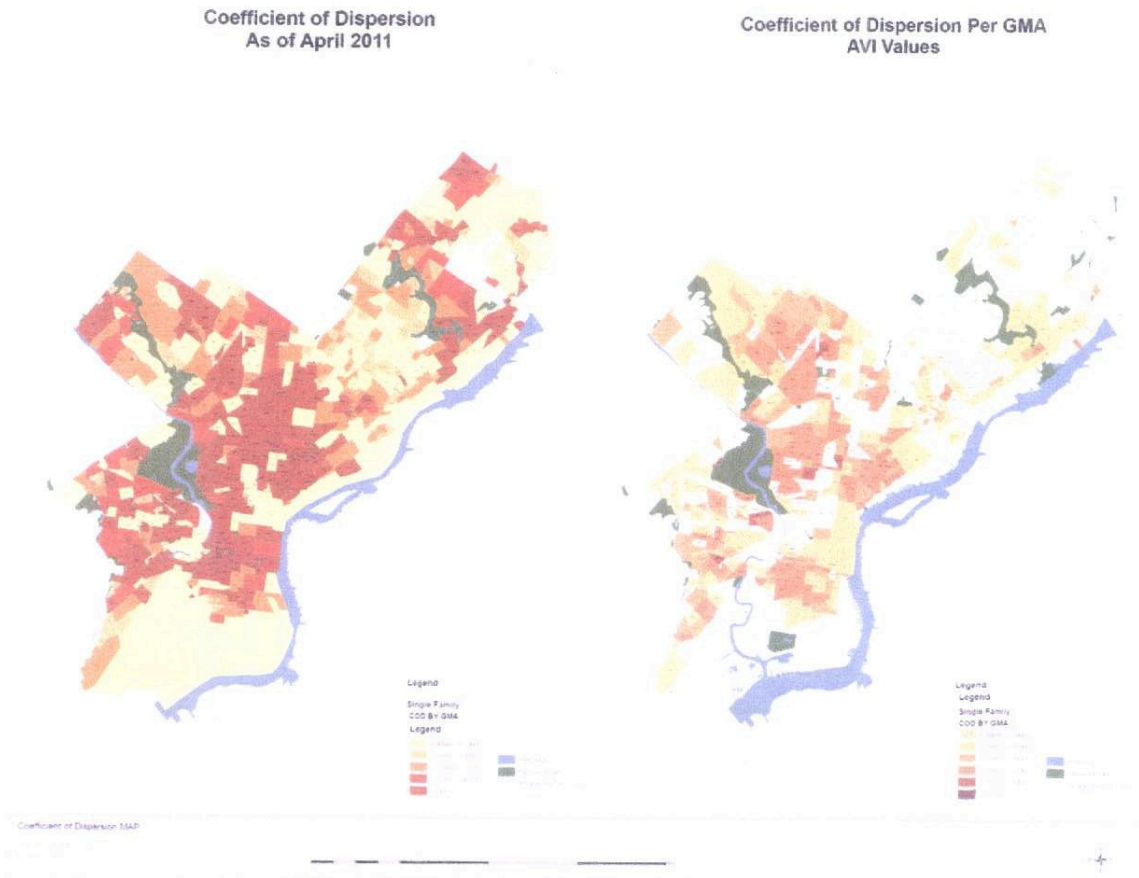
Example: In 20% of the cases the 2014 Market Value was within 3.5% of the sales price for Single Family Properties.

Percentile	Single Family	Multi-Family	Condos	Apartments	Mixed Use*	Commercial*	Industrial*
10th	1.6%	1.8%	4.5%	3%	6.7%	3.3%	5.4%
20th	3.5%	3.8%	8.9%	7%	12.9%	12.7%	14.9%
30th	5.4%	5.7%	12.7%	10%	19.6%	18.4%	22.4%
40th	7.4%	7.7%	16.0%	14%	26.9%	26.2%	29.8%
50th	9.6%	10.1%	19.1%	17%	37.7%	31.7%	42.2%
60th	12.3%	12.8%	22.0%	20%	50.7%	39.8%	55.2%
70th	15.6%	16.8%	25.3%	24%	68.2%	53.6%	70.1%
80th	20.6%	22.3%	28.9%	29%	94.3%	86.9%	91.9%
90th	29.2%	31.6%	34.2%	38%	143.4%	221.2%	197.6%

* Sales for this class of property may not be the best indicator of value. Cost Approach, Income Approach, or a Hybrid sales approach may be more reliable.

Measuring the Accuracy of AVI Values

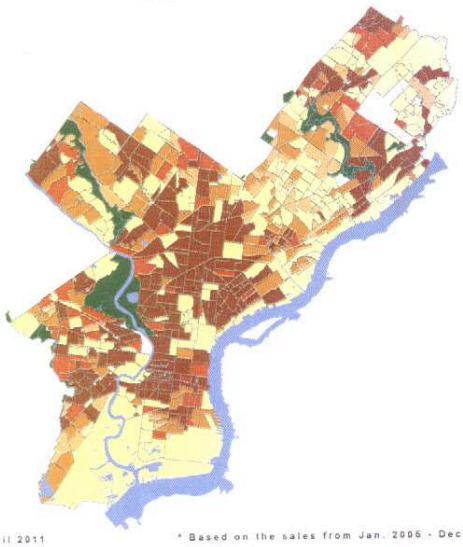
A successful Revaluation!



A visual representation of the change in assessment uniformity that was achieved through the 2014 revaluation.

From Start to Finish
CHANGE IN RATIO PERFORMANCE
City of Philadelphia

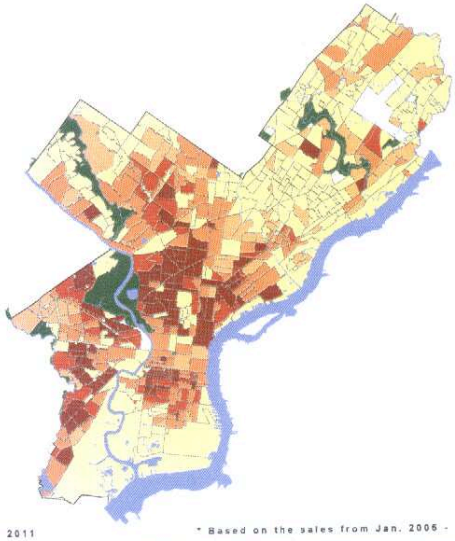
Before Outlier Removal



April 2011

* Based on the sales from Jan. 2006 - Dec. 2010

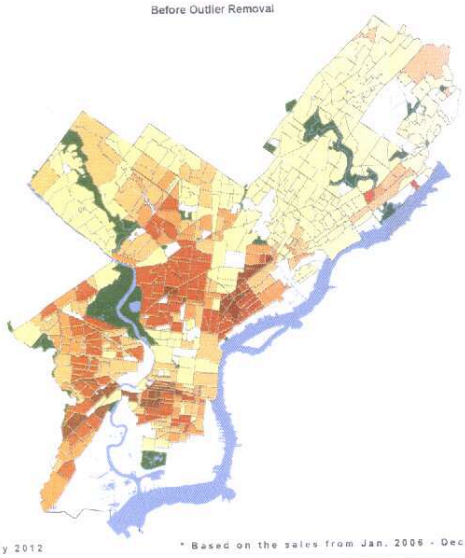
After Outlier Removal



April 2011

* Based on the sales from Jan. 2006 - Dec. 2010

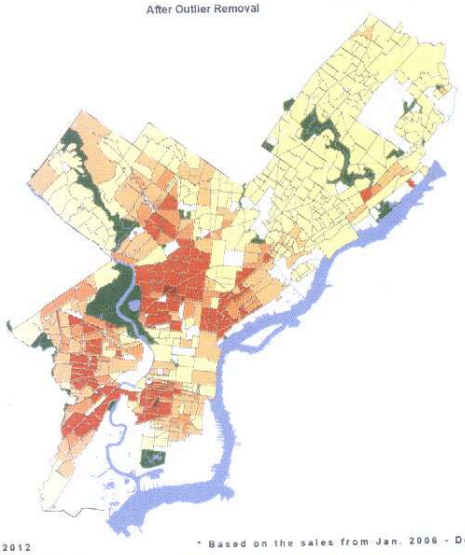
Before Outlier Removal



July 2012

* Based on the sales from Jan. 2006 - Dec. 2011

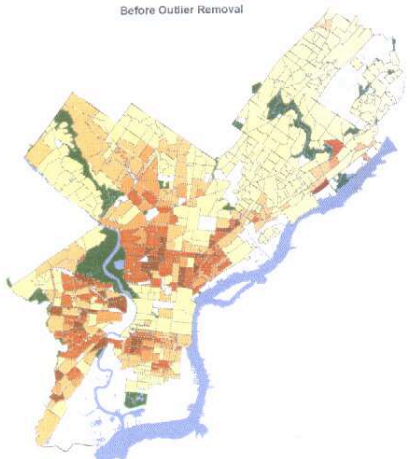
After Outlier Removal



July 2012

* Based on the sales from Jan. 2006 - Dec. 2011

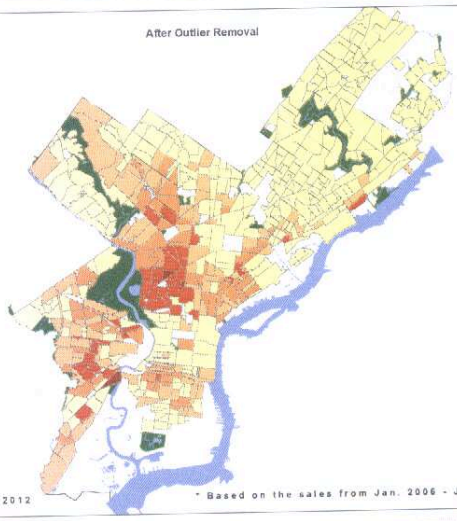
Before Outlier Removal



Sept 2012

* Based on the sales from Jan. 2006 - June 2012

After Outlier Removal



Sept 2012

* Based on the sales from Jan. 2006 - June 2012

City of Philadelphia - GMA Map

Coefficient of Dispersion

0.00 - 0.15
0.16 - 0.20
0.21 - 0.25
0.26 - 0.40
> 0.40

Challenges of AVI

Philadelphia is a very large, old city with a wide variety of property types and a large number of geographic market areas

We faced many challenges in planning and executing the AVI revaluation:

- Legacy of less than optimal business practices that did not promote uniform values or levels of assessment between various classes of property, or within a given class of property
- Serious deficiencies in the data files that effected the potential accuracy of any mass appraisal effort
- Outdated computer hardware
- Critical levels of understaffing in all units and divisions
- Lack of consistent standards for Sales Validation and for data gathered in the field
- Lack of integrated CAMA software to support a project of this scope and magnitude
- The market experienced both a large rise and a significant drop since the last mass appraisal

Any of these issues could have caused the failure of the entire project.

Setting Realistic Goals

- We believed it was critical to set realistic goals and performance standards for the Mass Appraisal effort.
- We wanted to inspect all properties and standardize the way that data was collected
- We wanted to validate six years of sales for all property types and capture the characteristics at time of sale
- We wanted to review the Geographic Market Area definitions , and make changes or revisions to optimize performance
- We wanted to use regression models to project values wherever we thought the data would yield good results
- We wanted all classes of property to have a median level of assessment of between 95% and 102%
- We wanted a citywide Coefficient of Dispersion of less than 20%
- We wanted a citywide Price Related Differential of between .98 and 1.05
- We wanted accuracy within 10% 50% of the time, and within 20% 80% of the time

Ratio Studies

Performance is usually measured by comparing predicted market values against the actual, adjusted or time adjusted prices of the properties in the inventory that have sold within the analysis period. The relationship between market value and sale price is commonly expressed as a percentage and referred to as 'the ratio'. Ratio studies that are run against the sales used in the model are part of the model calibration process. A holdout sample is a file of validated transactions that were not used in the valuation process, including new sales that transacted between the date of appraisal and the date of the study. Ratio studies are also run against the holdout sample.

Measures of Performance

The assessment industry recognizes some standard measures of performance

- Level of Assessment (Median Ratio) - What is the typical relationship between Market Value and Sale Price?
- Horizontal Equity (Coefficient of Dispersion) - What is the average absolute percentage difference between the Market Value and Sale Price?
- Vertical Equity (Price Related Differential) - Does the level of assessment remain the same as prices increase? Are we valuing low priced and high priced properties at similar levels of assessment?
- Degree of accuracy – What percentage of the time are the values with a desired 'closeness' to sales prices?
- Reliability of the model (Adjusted R_2)– What percentage of all observed variance in sale price is explained by the model?

Exceeding Expectations

Summarizing performance results for single family properties, we met or exceeded our 1st year goals in this revaluation

Measure	1st Year Goal	2nd Year Goal	2014 Result
Median Ratio	.95 – 1.02	.95 – 1.02	.99
Price Related Differential	.98 – 1.05	.98 – 1.03	1.037
Coefficient of Dispersion	.20	.15	.139
Model Reliability	.80	.85	.844
Accuracy at 50th percentile	Within 10%	Within 7.5%	Within 9.6%
Accuracy at 80th percentile	Within 20%	Within 15%	Within 20.6%

A Valid Ratio Study

In a Ratio study, the analyst should be trying to isolate variance in the market value to sales price relationship that is attributable to errors in the estimation processes and procedures. Estimation errors that are attributable to flaws in the data should be minimized or eliminated. This requires both an understanding of the data as well as a high degree of skill in managing the data files.

The Sales File

- Must include all transactions for the analysis period
- Invalid sales should be removed from consideration
- Truncation of up to 10% is allowable to remove sales that are not good indicators of value, although we chose to use a 2% truncation
- Should use Time Adjusted Sale Price

The Value File

- Must include values for all properties in the study

There are many mistakes that can be made in building and filtering the sales file that will lead to erroneous conclusions, therefore only a qualified analyst should be engaged.

Improving Performance

Based on our analyses and extensive interviews with our staff and expert consultants, we have plans to implement enhancements and refinements to our business practices and valuation processes that will significantly improve the performance of our next revaluation. Among these are:

- Data quality improvement
- Better training for the staff
- Expanding use of income data for non-residential properties
- Improving the software environment
- Focusing efforts in areas that need the most improvement
- More accurate land models
- Regression model maturity
- Use of multiple methods of estimating value and reconciling results
- Expanding use of expert consultants